

WHAT IS CLAIMED IS:

1. A method for manufacture of autograft, allograft and xenograft implants which comprises assembling such implants from smaller pieces of graft materials to form a larger graft implant product.
2. A kit comprising assemblable parts of autograft, allograft and xenograft implants for assembling such implants from smaller pieces of graft materials to form a larger graft implant product which may be formed in the course of a surgical procedure to precisely meet the needs of a given patient or procedure.
3. A method of strengthening or reinforcing autograft, allograft and xenograft implants which comprises assembling such implants from smaller pieces of graft materials to form a larger graft implant product.
4. The method of claim 3 wherein the reinforced product is cancellous bone into which is inserted reinforcing material.
5. The method according to claim 4 wherein said reinforcing material comprises cortical bone.
6. A graft implant comprising any one or combinations of allograft materials, autograft materials, xenograft materials, synthetic materials, metallic materials assembled into a an assembled implant which is assembled into a single graft by use of reinforcing material to hold the constituent pieces of graft materials together.
7. The graft implant according to claim 6 wherein said reinforcing material comprises cortical bone.

- 1 8. The graft implant according to claim 6 wherein the assembled implant is pre-
2 treated or treated after assembly to incorporate biologically active or inert
3 materials.
- 1 9. An implant comprising segments of cortical bone, cancellous bone, cortical-
2 cancellous bone, or combinations thereof pinned to each other by means of
3 cortical bone pins, wherein, prior to assembly or after assembly, the graft
4 materials are soaked, infused, impregnated, coated or otherwise treated with bone
5 morphogenetic proteins (BMP's), antibiotics, growth factors, nucleic acids,
6 peptides, or combinations thereof.
- 1 10. The implant according to claim 6 comprising an assembled cancellous block, or
2 dowel, harvested from the iliac crest or another suitable site to form a Cloward
3 Dowel, iliac crest wedge, or cancellous bone block, dowel, reinforced by insertion
4 therein of cortical bone pins.
- 1 11. The implant according to claim 6 comprising a cortical bone implant reinforced
2 by insertion therein of at least one cortical bone pin.
- 1 12. The implant according to claim 6 comprising an assembled implant comprising
2 different segments of cortical bone, cancellous bone or both.
- 1 13. The implant according to claim 6 comprising an assembled implant comprising
2 different segments of cortical bone, cancellous bone, demineralized cortical or
3 cancellous bone, synthetic material, and combinations thereof.
- 1 14. The implant according to claim 13 wherein insertion of reinforcing pins provides
2 an implant with multiple load-bearing pillars.
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- 1 15. The implant according to claim 14 wherein said pins protrude from the surface of
2 the implant to engage with inferior, superior or both surfaces of bone between
3 which the implant is inserted.
- 1 16. The implant according to claim 15 which is a spinal implant.
- 1 17. The implant according to claim 15 comprising a cancellous portion of bone
2 implant that has been compression molded, and then affixed to other portions of
3 cortical or cancellous bone machined according to different or similar principles.
- 1 18. The implant according to claim 6 in the form of a tapered dowel
- 1 19. A method of repairing a bone implant which comprises insertion therein of at
2 least one cortical bone pin.
- 1 20. The method according to claim 19 which further comprises affixing a piece of
2 bone to an existing bone implant by affixing said piece of bone to said cortical
3 bone pin.
- 1 21. The method according to claim 1 for making an instrument for insertion of other
2 implants.
- 1 22. The method according to claim 21 which is an implant driver.
- 1 23. A method for salvaging an implant that does not manufacturing specifications
2 which comprises insertion of at least one cortical bone pin at a site to reinforce
3 said site such that in combination with said at least one cortical bone pin, said
4 implant meets manufacturing specifications.

- 1 24. An assembled implant comprising a first bone segment pinned to a second bone
2 segment with a flexible tissue affixed between said first bone segment and said
3 second bone segment.
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- 1 25. The assembled implant according to claim 24 wherein said first and second bone
2 segments are affixed to each other by means of at least one cortical bone pin.
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- 1 26. A composite bone graft, comprising: a plurality of bone portions layered to form a
2 graft unit, and one or more biocompatible connectors for holding together said
3 graft unit, said biocompatible connectors do not comprise an adhesive.
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- 1 27. A composite bone graft comprising:
2 two or more distinct bone portions, and one or more biocompatible connectors,
3 wherein said biocompatible connectors hold together said two or more bone
4 portions to form said composite bone graft, said biocompatible connectors do not
5 comprise an adhesive.
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- 1 28. A composite bone graft comprising two or more connected, distinct, bone
2 portions, said connected, distinct, bone portions do not comprise an adhesive.
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- 1 29. A composite bone graft comprising three or more connected, distinct, bone
2 portions, said connected, distinct, bone portions are not connected with an
3 adhesive.
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- 1 30. The composite bone graft of any one of claim 26, wherein said bone portions are
2 selected from the group consisting of: cortical bone and cancellous bone.
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- 1 31. A composite bone graft, comprising:
2 a first bone portion;
3 a second bone portion;
4 a third bone portion, said first, second and third bone portions are layered to form
5 a graft unit; and
6 one or more biocompatible connectors for holding together said graft unit, said
7 biocompatible connectors do not comprise an adhesive.
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- 1 32. A composite bone graft, comprising:
2 a first cortical bone portion;
3 a second cortical bone portion;

a cancellous bone portion disposed between said first cortical bone portion and said second cortical bone portion to form a graft unit; and one or more biocompatible connectors for holding together said graft unit, said biocompatible connectors do not comprise an adhesive.

33. A composite bone graft, comprising:
a first cortical bone portion;
a second cortical bone portion provided on said first cortical bone to form a graft unit; and one or more biocompatible connectors, connecting said graft unit, said biocompatible connectors do not comprise an adhesive.
34. A composite bone graft, comprising:
a first bone portion;
a second bone portion provided on said first bone portion to form a graft unit; and one or more biocompatible connectors for holding together said graft unit, said biocompatible connectors do not comprise an adhesive.
35. A composite bone graft, comprising: a plurality of cortical bone portions layered to form a graft unit, and one or more biocompatible connectors for holding together said graft unit, said biocompatible connectors do not comprise an adhesive.
36. A composite bone graft, comprising:
one or more cortical bone portions layered to form a first unit;
one or more cortical bone portions layered to form a second unit;
one or more cancellous bone portions layered to form a third unit; said third unit disposed between said first unit and said second unit to form a graft unit; and
one or more biocompatible connectors for holding together said graft unit, said biocompatible connectors do not comprise an adhesive.
37. A composite bone graft, comprising:
a graft unit having one or more through-holes configured to accommodate one or more pins, said graft unit comprising:
two or more bone portions layered to form said graft unit, and
one or more pins connecting bone portions of said graft unit, said composite bone graft does not comprise an adhesive.
38. The composite bone graft of claim 37, said one or more pins comprising one or more biocompatible materials selected from the group consisting of: cortical bone; stainless steel; titanium; cobalt-chromium-molybdenum alloy; a plastic of one or more members selected from the group consisting of: nylon, polycarbonate, polypropylene, polyacetal, polyethylene, and polysulfone; and one or more bioabsorbable polymers.

- 1 39. The composite bone graft of claim 38, said two or more bone portions
2 comprising:
3 a first bone portion comprising one or more cortical bone portions;
4 a second bone portion comprising one or more cortical bone portions; and
5 a third bone portion comprising one or more cancellous bone portions disposed
6 between said first bone portion and said second bone portion to form said graft
7 unit.
- 1 40. The composite bone graft of claim 38, said one or more pins comprise one or
2 more cortical bone pins.
- 1 41. A composite bone graft, comprising:
2 a graft unit having one or more through-holes configured to accommodate one or
3 more pins, said graft unit comprising:
4 a first plate-like cortical bone portion;
5 a second plate-like cortical bone portion;
6 a plate-like cancellous bone portion disposed between said first plate-like cortical
7 bone portion and said second plate-like cortical bone portion to form said graft
8 unit, and
9 one or more cortical bone pins connecting bone portions of said graft
10 unit, said composite bone graft does not comprise an adhesive.
- 1 42. A composite bone graft, comprising:
2 a graft unit having one or more through-holes configured to accommodate
3 one or more pins, said graft unit comprising:
4 a first plate-like bone portion;
5 a second plate-like bone portion provided on said first plate-like bone to
6 form said graft unit, and
7 one or more bone pins for holding together said graft unit, said composite bone
8 graft does not comprise an adhesive.
- 1 43. A method for restoring vertical support of the posterior column, comprising
2 implanting a composite bone graft comprising two or more distinct bone portions
3 held together by one or more biocompatible connectors, at a site in a patient.
- 1 44. A composite bone graft, comprising:
2 a graft unit having one or more through-holes configured to accommodate one or
3 more pins, said graft unit comprising:
4 two or more bone portions layered to form said graft unit,
5 one or more pins connecting said bone portions of said graft unit, and
6 a centrally located through-hole disposed perpendicular to interfaces of layered
7 bone portions of said graft unit, said composite bone graft does not comprise an
8 adhesive.
- 1 45. A method for making a composite bone graft for implantation into a patient,
2 comprising:

stacking two or more parallel bone planks to form a graft unit;
 providing one or more through-holes in said graft unit perpendicular to I
 interfaces of bone planks;
 connecting said two or more parallel bone planks of said graft unit with
 one or more pins disposed in said one or more through-holes to form a pinned
 graft unit; and
 shaping said pinned graft unit to form said composite bone graft.

46. A composite bone graft, comprising:
 one or more cortical bone portions layered to form a first unit;
 one or more cortical bone portions layered to form a second unit;
 one or more demineralized cancellous bone portions layered to form a
 third unit; said third unit disposed between said first unit and said second unit to
 form a graft unit; and
 one or more biocompatible connectors for holding together said graft unit, said
 biocompatible connectors do not comprise an adhesive.

47. A composite bone graft, comprising:
 one or more cortical bone portions layered to form a first unit;
 one or more cortical bone portions layered to form a second unit;
 one or more demineralized cortical bone portions layered to form a third
 unit; said third unit disposed between said first unit and said second unit to form a
 graft unit; and
 one or more biocompatible connectors for holding together said graft unit,
 said biocompatible connectors do not comprise an adhesive.

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 49. A composite bone graft, comprising:
 a first unit comprising one or more bone portions;
 a second unit connected to said first unit, comprising one or more bone
 portions; and
 one or more biocompatible connectors for connecting said first unit and said
 second unit, wherein said first unit and said second unit are not in physical contact
 and define a void therebetween, said biocompatible connectors do not comprise
 an adhesive.

50. A composite bone graft, comprising: two or more distinct interlocking cortical
 bone portions.

51. A composite bone graft, comprising: two or more distinct adjacent bone portions
 where adjacent bone portions are configured to interlock with each other.

52. A composite bone graft, comprising: two or more distinct adjacent bone portions
 where adjacent bone portions are configured to interlock with each other, and one
 or more locking pins partially or entirely traversing a dimension of said composite
 bone graft.

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3 A composite bone graft, comprising: two or more distinct adjacent bone portions where adjacent bone portions are configured to interlock with each other to form an interlocked graft unit, said interlocked graft unit is self-locking.
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2 A composite bone graft, comprising: two or more distinct adjacent bone portions, said distinct adjacent bone portions comprising complementary peg-like protrusions and corresponding depressions, said protrusions and depressions interlock to provide an interlocking fit between said adjacent bone portions.
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2 A composite bone graft, consisting essentially of: two or more distinct adjacent bone portions where adjacent bone portions are configured to interlock with each other.
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2 A composite bone graft, consisting essentially of: two or more distinct adjacent bone portions, said distinct adjacent bone portions comprising complementary peg-like protrusions and corresponding depressions, said protrusions and depressions interlock to provide an interlocking fit between said adjacent bone portions.
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- 1 56.
1 57.
2 A composite bone graft, consisting essentially of: two or more distinct adjacent bone portions, said distinct adjacent bone portions comprising complementary peg-like protrusions and corresponding depressions, said protrusions and depressions interlock to provide an interlocking fit between said adjacent bone portions; and one or more locking pins partially or entirely traversing a dimension of said composite bone graft.
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1 58.
2 A composite bone graft, consisting essentially of: two or more distinct adjacent bone portions where adjacent bone portions are configured to interlock with each other, and one or more locking pins partially or entirely traversing a dimension of said composite bone graft.
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2 A composite bone graft, comprising: two or more distinct adjacent bone portions where adjacent bone portions are configured to interlock with each other to form an interlocked graft unit, and one or more locking pins traversing a dimension of said composite bone graft, to lock said interlocked graft unit.
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2 A composite bone graft, comprising: two or more distinct interlocking bone portions, said interlocking bone portions are self-locking.
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1 61.
2 A composite bone graft, comprising: two or more distinct interlocking bone portions, and one or more locking pins to lock said interlocking bone portions.